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ABSTRACT

Described is a presentation and learning session on groundwater, which is intended to educate advisory groups interested in improving water quality decision making. Among the areas addressed are the importance of groundwater, sources of contamination, and groundwater pollution control programs. These materials are part of the Working for Clean Water Project for citizen organizations. (Author/WB)

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Working for Clean Water

An Information Program for Advisory Groups

Groundwater Contamination

Instructor Guide

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION

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SE 035 554

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Groundwater Contamination

Groundwater is the largest source of fresh water commonly used by man. It serves 49% of the United States population. Groundwater has the distinct advantages of uniformity of quality and temperature at a given locality. Also because of the efficient filtering action that takes place in the soils as it flows downward the water is normally free of organisms and suspended solids. However, over the years, the dumping of liquid and solid wastes on or in the ground has contaminated many of the groundwaters. Causes of groundwater contamination include cesspools and septic tanks, leaking sewers, pipe lines, retention ponds, salt water encroachment, and irrigation return water.

Upon completion of this presentation the participant should be able to:

- understand what groundwater is and how it occurs
- recognize the importance of groundwater as a water supply and resource
- understand what is meant by groundwater contamination
- recognize potential sources of groundwater contamination
- propose a program to control groundwater contamination.

Required Materials

☐ 16mm film entitled "Groundwater - America's Buried Treasure" for the audiovisual presentation

☐ 16mm sound film projector and screen

☐ Set of flip charts plus easel or set of transparencies and overhead projector for guided discussion

☐ Copy of handbook, "Groundwater Contamination," for each participant

☐ A large scale map of the facility planning area plus a copy for each participant.

Important Notes

1. Determine the source of the community's water supply before the presentation (i.e., wells or surface water and location).

2. Determine the uses of groundwater in the area even if the community's water supply is from surface waters.

3. Make up a list of possible sources of groundwater contamination in the community including refuse and chemical dumps, lagoons, industry, and onsite disposal.

4. Prepare a large scale map of the facility planning area. Make up as a transparency or have enough copies to give to each participant.

5. Also prepare a map showing location of wells and potential or known sources of groundwater contamination.

6. If other groundwater problems are apparent in the area the instructor may want to emphasize them during the Guided Discussion.

Suggested Activities

Introductory Comments	5 minutes
A/V Presentation	15 minutes
Guided Discussion	25 minutes
Situation Exercises (optional)	30 minutes
Closing Remarks	5 minutes
TOTAL TIME	50-80 minutes

Introductory Comments (5 minutes)

1. Ask the participants if any of them use a well for their water supply.

2. Ask them why they have or prefer the well.

Possible reasons will include:

cheap, good quality, cold, no chlorine.

3. Present the objectives of this information session.

A/V Presentation (15 minutes)

1. Very briefly preview the material covered by the film:

- Groundwater makes up 95% of the earth's fresh water supply.

- Treatment and trasnfer costs are less than half that of surface water.

- Care must be taken to insure its purity against strip mining, oil drilling, and chemical and refuse dumps.

- Once polluted, there is no quick or simple way to clean it, maybe even no way! *Important point.*

2. Show the film, "Groundwater - America's Buried Treasure."

3. Ask the participants if there was anything brought out in the film that was applicable to this area.

Guided Discussion (25-35 minutes)

Encourage discussion. This is not to be a lecture!

1. Handout a copy of a la_ge scale map of the facility planning area to each participant.

2. Ask the participants where their water or the community's water comes from.

Combine all well locations on one map (or transparency) to use for discussion.

3. Even if the source is from surface water, ask them to mark known wells on the map. This can be done on a transparency that everyone can use.

4. Discuss the recharge area for the groundwater or the watershed for the surface water. Point out that during times when there is no rainfall even surface water or streams get their flow from groundwater.

Add contamination source location to map (or transparency). Encourage participants to mark well and contamination *locations on their own maps.*

5. Next ask the participants to mark the locations of possible sources of groundwater contamination.

6. Compare the locations that you previously determined with those marked by the participants.

7. Point out that even where there are few current uses of groundwater, it is still a resource. For example, a source of surface water springs.

8. The locations of wells and/or potential groundwater contamination sites may be the basis for a management plan that the advisory group may want to develop.

Situation Exercises (Optional - 30 minutes)

Situation sheets (1, 2, 3) are in the Appendix.

1. If time permits the participants may be divided into several groups to evaluate the situation exercises and discuss solutions. At least 30 minutes will be required to accomplish these exercises.

Conduct the exercises in the following way:

a. Assign the participants in groups of three persons.

b. Pass out situation sheets to each person.

c. Give each group two to three minutes to discuss their responses.

d. Ask for a show of hands on various options.

e. Then skillfully explore why people made the decisions that they did, getting them to relate their personal experiences and insights.

f. There are no absolutely right or wrong answers.

Closing Remarks (5 minutes)

1. Address any remaining questions from the participants.

2. Summarize the main points discussed in the session.

Refer to the objectives at beginning of Instructor Guide to be sure that they were accomplished.

Selected Resources

Freeze, Allan R., and Cherry, John A., ed. Groundwater. NJ: Prentice-Hall, Inc., 1979. 604 pp.

A new textbook on the subject of groundwater that has been well received by experts in the field. Unlike previous texts, it has strong sections on ground water quality and contamination. The subjects of chemistry, physics, geology, hydrology, and engineering are integrated to a greater degree than in other texts. The book is very readable for such an advanced level textbook. The book is available from Prentice-Hall Inc., Englewood Cliffs, NJ 07632.

Quality Criteria for Water. Washington, DC: U.S. Environmental Protection Agency, Office of Water and Hazardous Materials, July 1976. 256 pp.

Lists basic water constituents and pollutants giving a recommended criterion for each, an introduction, a rationale supporting the criterion and a list of references cited in the development of the recommendation. The cost is $3.50 and is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The order number is 055-001-01049-4.

Todd, David Keith, et al., ed. Polluted Groundwater: A Review of the Significant Literature. Syosset, NY: Water Information Center Inc., 1976. 179 pp.

This book reviews the significant literature on man-caused ground water pollution, including causes, occurrences, procedures for control, and methods for monitoring. Some 30 specific topics are covered within the chapter headings of urban pollution, industrial pollution, agricultural pollution, pollution from wells, salt water and surface water, pollutants and effects, and evaluating pollution. Rather than simply preparing an annotated bibliography, the authors, after studying 595 references have written a review in essay form on a subject basis. The format is highly readable. This book is based upon the text of a government document of the same title, EPA-600/4-74-001 published in March 1974. Available for $18 from the publisher at 6800 Jericho Turnpike, Syosset, NY 11791.

van der Leeden, Frits, ed. Ground Water: A Selected Bibliography. 2nd ed. Syosset, NY: Water Information Center Inc., 1974. 146 pp.

This is a general bibliography on ground water that contains all the basic and "classic" references on the subject. About 1750 key references are listed under 32 subject hearings. This book is available for $18 from Water Information Center, Inc., 6800 Jericho Turnpike, Syosset, NY 11791.

Miller, David W. The Report to Congress: Waste Disposal Practices and Their Effects on Ground Water. Report No. EPA-570/9-77-001. Washington, DC: U.S. Environmental Protection Agency, Office of Water Supply, January 1977. 512 pp.

This report describes the results of an investigation into: (1) the disposal of waste which may endanger underground water which supplies, or can reasonably be expected to supply, any public water systems and (2) the means of control of such waste disposal. The report is comprehensive, readable and filled with facts and figures. Numerous case histories and examples are included. Available in summary form (PB-265 364/OWP) for $4.50 or as a full report (PB-265 081/OWP) for $13 from NTIS, 5258 Port Royal Road, Springfield, VA 22161.

Appendix

A. Handouts for use in the Situation Exercise.

1. Situation One

2. Situation Two

3. Situation Three

Situation One

Your town of five thousand gets its water from three wells. These wells are on the edge of farm land and increasing nitrate levels have been noticed in the past several years. Nitrate harmful to infants and limited by the drinking water standards may originate from both septic tanks on the edge of your town or from manure or fertilizers on the farmer's fields. The town has as an alternate water supply a stream passing nearby. The water quality is acceptable but not good enough for a public water supply.

(Choose one or more)

_____ (a) Purchase all adjacent farm land.

_____ (b) Ask the state department of environmental resources to regulate manure spreading and fertilization on the farmer's fields.

_____ (c) Sewer all adjacent residences.

_____ (d) Treat the water using ion exchange.

_____ (e) Use the stream as a water supply.

_____ (f) Other: _____

_____

SITUATION TWO

The town's water supply is a small stream. A dam provides a pool to withdraw water for the water treatment plant. In the watershed of the stream is an abandoned chemical plant and what appears to be several lagoons. The stream water quality does not seem impaired at this time. What should the town do?

(Choose one or more)

_____ (a) Do nothing until a problem occurs.

_____ (b) Ask the state to make analyses in the area to determine what contaminants are present.

_____ (c) Hire a contractor to pump out the lagoons and dispose of the material properly.

_____ (d) Sink several wells around the site to monitor the groundwater.

_____ (e) Other: _____

_____

SITUATION THREE

Your town has a well as its sole source of water. What should and can be done to protect it from groundwater contamination?

(Choose one or more)

_____ (a) Land use planning.

_____ (b) Zoning.

_____ (c) Industrial waste disposal laws

_____ (d) Monitoring wells

_____ (e) Water quality surveillance on the existing wells.

_____ (f) Other: _____

_____

Working for Clean Water is a program designed to help advisory groups improve decision making in water quality planning. It aims at helping people focus on essential issues and questions, by providing trained instructors and materials suitable for persons with non-technical backgrounds. These materials include a citizen handbook on important principles and considerations about topics in water quality planning, an audiovisual presentation, and instructor guide for elaborating points, providing additional information, and engaging in problem-solving exercises.

This program consists of 18 informational units on various aspects of water quality planning:

- Role of Advisory Groups
- Public Participation
- Nonpoint Source Pollution: Agriculture, Forestry, and Mining
- Urban Stormwater Runoff
- Groundwater Contamination
- Facility Planning in the Construction Grants Program
- Municipal Wastewater Processes: Overview
- Municipal Wastewater Processes: Details
- Small Systems
- Innovative and Alternative Technologies
- Industrial Pretreatment
- Land Treatment
- Groundwater Contamination
- Multiple Use
- Environmental Assessment
- Cost-Effectiveness Analysis
- Wastewater Facilities Operation and Maintenance
- Financial Management

The units are not designed to make technical experts out of citizens and local officials. Each unit contains essential facts, key questions, advice on how to deal with the issues, and clearly-written technical backgrounds. In short, each unit provides the information that citizen advisors need to better fulfill their role.

This program is available through public participation coordinators at the regional offices of the United States Environmental Protection Agency.